

CLAIMS

What is claimed is:

1. A forwarding communication network configured as a daughter network coupled to a parent network, said communication network comprising:

a hub access-point (HAP) device coupled to said parent network and configured to engage in outward communication over a first wireless channel;

a plurality of forwarding access-point (FAP) devices, wherein a first portion of said plurality of FAP devices is configured to engage in inward communication over said first wireless channel, and wherein a second portion of said plurality of FAP devices is configured to engage in outward communication over a second wireless channel; and

a plurality of customer-premise-equipment (CPE) devices, wherein each CPE device in said plurality of CPE devices is configured to engage in inward communication over said second wireless channel, and wherein said HAP device is in communication with one of said CPE devices through an FAP device in each of said first and second portions of said plurality of FAP devices.

2. A forwarding communication network as claimed in claim 1 additionally comprising an additional CPE device configured to engage in inward communication over said first wireless channel.

3. A forwarding communication network as claimed in claim 1 wherein:

an FAP device in said first portion of said plurality of FAP devices is also said FAP device in said second portion of said plurality of FAP devices;

said HAP device is configured to engage in outward communication with said FAP device over said first wireless channel;

said FAP device is configured to engage in inward communication with said HAP device and is configured to engage in outward communication with said one CPE device over said second wireless channel; and

said one CPE device is configured to engage in inward communication with said FAP device over said second wireless channel.

4. A forwarding communication network as claimed in claim 1 wherein:

said first wireless channel is provided at a first frequency; and

said second wireless channel is provided at a second frequency different from said first frequency.

5. A forwarding communication network as claimed in claim 1 wherein:

a first FAP device is in said first portion of said plurality of FAP devices;

a second FAP device is in said second portion of said plurality of FAP devices;

said HAP device is configured to engage in outward communication with said first FAP device over said first wireless channel;

said first FAP device is configured to engage in inward communication with said HAP device over said first wireless

channel and is configured to engage in outward communication with said second FAP device over a third wireless channel;

said second FAP device is configured to engage in inward communication with said first FAP device over said third wireless channel and is configured to engage in outward communication with said CPE device over said second wireless channel; and

said one CPE device is configured to engage in inward communication with said second FAP device over said second wireless channel.

6. A forwarding communication network as claimed in claim 1 wherein said communication network additionally comprises a hub-user communication link of N hops, where N is a positive integer greater than 1, and wherein:

said hub-user communication link couples said HAP device to said one CPE device through N-1 sequential ones of said FAP devices; and

each of said hops is effected over a wireless channel having a frequency different from frequencies of wireless channels of conjoined ones of said hops.

7. A forwarding communication network as claimed in claim 1 wherein:

an FAP device in one of said first and second portions of said plurality of FAP devices effects said inward communication with a first directionality; and

said FAP device effects said outward communication with a second directionality, wherein said first directionality is more directional than said second directionality.

8. A forwarding communication network as claimed in claim 1 wherein an FAP device in said plurality of FAP devices includes one of said CPE devices.

9. A forwarding communication network as claimed in claim 1 wherein each of said outward and inward communications is bidirectional.

10. A forwarding communication network as claimed in claim 1 wherein said HAP device is a first HAP device, and wherein said communication network additionally comprises a second HAP device coupled to said parent network and configured to engage in outward communication.

11. A forwarding communication network as claimed in claim 1 wherein said inward communication is connectionless inward communication and said outward communication is connectionless outward communication.

12. A forwarding communication network configured to minimize system resources over a region in which communication services are provided, said communication network comprising:

a hub access-point (HAP) device coupled to a parent network and configured to engage in connectionless first-hop outward transmissions;

a forwarding access-point (FAP) device configured to engage in connectionless first-hop inward transmissions and in connectionless second-hop outward transmissions;

a first plurality of customer-premise-equipment (CPE) devices, wherein each CPE device in said first plurality of CPE devices is configured to engage in connectionless first-hop

inward transmissions, wherein a first wireless channel is shared among said connectionless first-hop outward and inward transmissions; and

a second plurality of CPE devices, wherein each CPE device in said second plurality of CPE devices is configured to engage in connectionless second-hop inward transmissions, wherein a second wireless channel is shared among said connectionless second-hop outward and inward transmissions.

13. A forwarding communication network as claimed in claim 12 wherein said CPE devices in said first and second pluralities of CPE devices are configured to concurrently engage in communication sessions through said parent network.

14. A forwarding communication network as claimed in claim 13 wherein:

connectionless outward and inward communications with said CPE devices in said first plurality of CPE devices during said communication sessions are conveyed over said first wireless channel exclusively; and

connectionless outward and inward communications with said CPE devices in said second plurality of CPE devices during said communication sessions are conveyed over said first and second wireless channels.

15. A forwarding communication network as claimed in claim 12 wherein:

said FAP device is configured to transmit hop-count data, wherein said hop-count data identifies said FAP device is one hop removed from said HAP device; and

each CPE device in said second plurality of CPE devices is configured to receive said hop-count data.

16. A forwarding communication network as claimed in claim 12 wherein said FAP device is a first FAP device and wherein said communication network additionally comprises:

a second FAP device configured to engage in connectionless second-hop inward transmissions and in connectionless third-hop outward transmissions; and

a third plurality of CPE devices, wherein each CPE device in said third plurality of CPE devices is configured to engage in connectionless third-hop inward transmissions, wherein a third wireless channel is shared among said connectionless third-hop outward and inward transmissions.

17. A forwarding communication network as claimed in claim 16 wherein:

said CPE devices in said first, second, and third pluralities of CPE devices are configured to concurrently engage in communication sessions through said parent network;

connectionless outward and inward communications with said CPE devices in said first plurality of CPE devices during said communication sessions are conveyed over said first wireless channel exclusively;

connectionless outward and inward communications with said CPE devices in said second plurality of CPE devices during said communication sessions are conveyed over said first and second wireless channels exclusively; and

connectionless outward and inward communications with said CPE devices in said third plurality of CPE devices during said communication sessions are conveyed over said first, second, and third wireless channels.

18. A forwarding communication network as claimed in claim 16 wherein:

said first FAP device includes a directional antenna aimed at said HAP device; and

said second FAP device includes a directional antenna aimed at said first FAP device.

19. A forwarding communication network as claimed in claim 16 wherein:

said HAP device, said first FAP device, and said second FAP device are each configured to transmit hop-count data, wherein said hop-count data identifies a number of hops to said HAP device; and

said first FAP device, said second FAP device, and said CPE devices in said first, second, and third pluralities of CPE devices are each configured to receive said hop-count data.

20. A forwarding communication network as claimed in claim 16 wherein:

said first FAP device and said second FAP device are each configured to transmit capacity data, wherein said capacity data identifies a capacity for forwarding connectionless inward transmissions toward said HAP device; and

said second FAP device and said CPE devices in said second and third pluralities of CPE devices are each configured to receive said capacity data.

21. A forwarding communication network as claimed in claim 16 wherein each of said first, second, and third wireless channels occupies an unlicensed portion of the radio spectrum.

22. A forwarding communication network as claimed in claim 16 wherein said HAP device, said first and second FAP devices, and said CPE devices in said first, second, and third

pluralities of CPE devices are operated in accordance with an IEEE 802.11 standard for wireless local area networks.

23. A forwarding communication network as claimed in claim 16 wherein:

said first wireless channel is provided at a first frequency;

said second wireless channel is provided at a second frequency different from said first frequency; and

said third wireless channel is provided at a third frequency different from said first and second frequencies.

24. A forwarding communication network as claimed in claim 12 wherein:

said HAP and FAP devices are substantially stationary; and

said FAP device includes a directional antenna aimed at said HAP device.

25. A forwarding communication network as claimed in claim 12 wherein said FAP device includes one of said CPE devices in said first plurality of CPE devices.

26. A forwarding communication network as claimed in claim 12 wherein:

said HAP device is configured to receive said connectionless first-hop inward transmissions conveyed by said first wireless channel;

said FAP device is configured to receive said connectionless first-hop outward transmissions conveyed by said first wireless channel;

said FAP device is additionally configured to receive said connectionless second-hop inward transmissions conveyed by said second wireless channel;

each CPE device in said first plurality of CPE devices is configured to receive said connectionless first-hop outward transmissions conveyed by said first wireless channel; and

each CPE device in said second plurality of CPE devices is configured to receive said connectionless second-hop outward transmissions conveyed by said second wireless channel.

27. A method of allocating wireless channels in a forwarding communication network, said method comprising:

- a) coupling a hub access-point (HAP) device of said communication network to a parent network;
- b) configuring $N-1$ forwarding access-point (FAP) devices, where N is a positive integer greater than 1, wherein for $M=M_{\text{MIN}}=1$ to $M=M_{\text{MAX}}=(N-1)$ each M^{th} FAP device is configured to engage in inward communication over an M^{th} wireless channel and to engage in connectionless outward communication over an $(M+1)^{\text{th}}$ wireless channel;
- c) configuring said HAP device to engage in outward communication over said $M_{\text{MIN}}^{\text{th}}$ wireless channel;
- d) configuring a customer-premise-equipment (CPE) device to engage in inward communication over said $M_{\text{MAX}}^{\text{th}}$ wireless channel;
- e) establishing a hub-user communication link having N hops between said HAP device and said CPE device through $N-1$ sequential ones of said FAP devices; and
- f) executing said outward and inward communications over said hub-user communication link.

28. A method as claimed in claim 27 wherein, prior to said configuring activity b), said method additionally comprises:

analyzing said communication network to determine potential paths for said hub-user communication link;

determining which of said potential paths is an optimal path for said hub-user communication link;

ascertaining a number of hops in said optimal path; and
setting N equal to said number of hops.

29. A method as claimed in claim 27 wherein conjoined ones of said N wireless channels have different frequencies.

30. A method as claimed in claim 27 wherein:

said method additionally comprises determining channel interference ranges of said HAP device, each of said N-1 FAP devices, and said CPE device; and

said configuring activity b), for said each Mth FAP device of said N-1 FAP devices, comprises:

noting frequencies of wireless channels of already-configured ones of said N-1 FAP devices residing in said interference ranges of said HAP device, each of said N-1 FAP devices, and said CPE device in which said each Mth FAP device resides;

assigning said Mth wireless channel of said Mth FAP device at a frequency different from said

frequencies noted by said noting activity; and

assigning said (M+1)th wireless channel of said Mth FAP device at a frequency different said frequency of said Mth wireless channel of said Mth FAP device and different from said frequencies noted by said noting activity.

31. A method as claimed in claim 27 wherein, for said each M^{th} FAP device of said N-1 FAP devices, said configuring activity b) comprises assigning said M^{th} and $(M+1)^{\text{th}}$ wireless channels at frequencies in an unlicensed portion of the radio spectrum.

32. A forwarding communication network for providing communication throughout a region, said communication network comprising:

a hub access-point (HAP) device coupled to a parent network and configured to engage in connectionless outward communication within a range of said HAP device over a first wireless channel, said range of said HAP device being a portion of said region;

a plurality of forwarding access-point (FAP) devices, wherein each FAP device in said plurality of FAP devices is configured to engage in connectionless inward communication and connectionless outward communication within a range of said each FAP device, each of said ranges of said FAP device being a portion of said region, and wherein one FAP device in said plurality of FAP devices is positioned within said range of said HAP device and configured to engage in said connectionless inward communication with said HAP device over said first wireless channel; and

a plurality of customer-premise-equipment (CPE) devices positioned outside of said range of said HAP device, wherein each CPE device in said plurality of CPE devices is positioned within said range of said one FAP device and configured to engage in connectionless inward communication with said one FAP device over a second wireless channel.

33. A forwarding communication network as claimed in claim 32 wherein:

said first wireless channel is provided at a first frequency; and

said second wireless channel is provided at a second frequency different from said first frequency.

34. A forwarding communication network as claimed in claim 32 wherein:

said HAP device is configured to engage in said connectionless outward communication with a first FAP device in said plurality of FAP devices over said first wireless channel, wherein said first FAP device is located within said range of said HAP device;

said first FAP device is configured to engage in said connectionless inward communication with said HAP device over said first wireless channel;

said first FAP device is additionally configured to engage in said connectionless outward communication with a second FAP device in said plurality of FAP devices over a third wireless channel, wherein said second FAP device is located within a range of said first FAP device;

said second FAP device is configured to engage in said connectionless inward communication with said first FAP device over said third wireless channel;

said second FAP device is additionally configured to engage in said connectionless outward communication with one CPE device in said plurality of CPE devices over said second wireless channel, wherein said one CPE device is located within a range of said second FAP device; and

said one CPE device is configured to engage in said connectionless inward communication with said second FAP device over said second wireless channel.

35. A forwarding communication network as claimed in claim 32 wherein:

said HAP device utilizes a substantially non-directional antenna to effect said connectionless outward communication;

each FAP device in said plurality of FAP devices utilizes a directional antenna to effect said connectionless inward communication;

each FAP device in said plurality of FAP devices utilizes a substantially non-directional antenna to effect said connectionless outward communication; and

each CPE device in said plurality of CPE devices utilizes a substantially non-directional antenna to effect said connectionless inward communication.

36. A forwarding communication network as claimed in claim 35 wherein said directional antenna of said each FAP device is substantially aimed at an antenna of one of said HAP device and another FAP device in said plurality of FAP devices.

37. A forwarding communication network as claimed in claim 32 wherein:

said HAP device is a first HAP device configured to engage in connectionless outward communication within a first range of said HAP device, said first range of said HAP device being a portion of said region;

said communication network additionally comprises a second HAP device coupled to said parent network and configured to engage in connectionless outward communication within a second range of said HAP device, said second range of said HAP device being a portion of said region; and

one FAP device in said plurality of FAP devices is positioned within said second range of said HAP device and

configured to engage in said connectionless inward communication with said second HAP device.

38. A forwarding communication network as claimed in claim 37 wherein:

said first HAP device is configured to engage in connectionless outward communication over said first wireless channel having a first frequency;

said second HAP device is configured to engage in connectionless outward communication over a third wireless channel having a third frequency different from said first frequency; and

said one FAP device positioned within said second range of said HAP device is configured to engage in said connectionless inward communication with said second HAP device over said third wireless channel.

39. A forwarding communication network as claimed in claim 37 additionally comprising:

a first hub-user communication link of N hops, where N is a positive integer greater than 1, wherein said first hub-user communication link couples said first HAP device to one of said CPE devices through N-1 sequential ones of said FAP devices;

a second hub-user communication link of L hops, where L is a positive integer greater than 1, wherein said second hub-user communication link couples said second HAP device to said one CPE device through L-1 sequential ones of said FAP devices; and

each of said hops in said first and second hub-user communication links is effected over a wireless channel having a frequency different from frequencies of wireless channels of conjoined ones of said hops.